g2p/GEp experiment readiness review

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Charge with committee responses

- Will all the required special experimental equipment and/or configuration modifications be available by the scheduled date?

This appears to be the case. However we are unable to provide a complete answer to this question at this time because the experimental setup is not finalized yet. We have asked the collaboration to finalize the setup by May 20th; please see the attached report.

- Have all the jobs that need to be done to mount the experiment been identified and defined adequately? Yes

- Have progress milestones been identified that will permit thoughtful tracking of the probability of the ultimate success of the mounting of the experiment? Yes
- Are the responsibilities for carrying out each job identified, and are the manpower and other resources necessary to complete them on time in place? (Both Jefferson Lab and the collaboration must be included here!) Yes
- Are the collaboration's plans for building up an "on site" effort adequate to meet this schedule? Yes
- Will the accelerator be capable of delivering the required beam? Yes, and see the report.
- Will all necessary ancillary tests of beam capability, monitoring equipment, etc. have been completed prior to the start of the experiment? Yes
- Is the scheduled beam time adequate to carry out the entire measurement, including all setup, commissioning, calibrations, etc.?
  Not as presented during the review; the spokespeople of the experiments need to optimize the available beam time maximizing the physics outcome given the finalized experimental setup.
- Are the plans for completing the EH&S reviews and documentation required for running the experiment adequate and appropriate? Yes, and see the attached notes.
- Is the tentatively scheduled date consistent with the constraints of the collaboration? Yes (with the finalizing the setup by May 20th)

g2p/GEp experiment readiness review Committee Report

We would like to congratulate the collaboration for a well coordinated strong effort to mount this demanding experiment. The review showed us that the collaboration is well organized and has established very good communication and coordination with different divisions involved. The preparation for the g2p installation looks to be in very good shape. Engineering Division has provided very thorough support of this installation and the collaboration has done an excellent job building up the required manpower to get the experiment running.

The big advantage this collaboration has is that it has sufficient installation time; a six month down is really ideal considering the amount of work required. When Hall C first operated the UVA target they only had three months and besides the target they had to construct a large third arm in Hall C. That job was completed with only a two week delay.

Main Issues

1. The collaboration has identified a serious issue with the setup; the significant increase in the effective scattering angle due to the bending of scattered electrons due to target field. The collaboration is currently working very hard to reconfigure some of the parameters to minimize the effects due to this issue. Three possible solutions were discussed during the review:
    1. Reduce the target field to 2.5 T for some kinematics – this seems to be a firm decision.
    2. Raise target by 9 cm for some kinematics, or
    3. Allow the beam to impinge on the target at some non-zero angle.

It appears that the collaboration is leaning towards option 3 instead of option 2. The collaboration must fix all run parameters and experiment conditions sooner rather than later, since even seemingly innocuous things like the lowering of the target field to 2.5 T but leaving the beam trajectory equivalent to a 5T target has ramifications. The beam dump may have to move/modified and some of the Rad Con calculations may need to be revised. Raising the Target by 9 cm has big ramifications.

We would like request that the collaboration finalize the experimental setup by May 20th and present a report to this committee on the changes. We have the following specific questions/concerns about the proposed setup with the beam incident on the target with an upward angle (instead of horizontally as presented at the review)

- What is the maximum upward angle achievable (given mechanical and beam optics constraints and the minimum target field) ?
- Beam optics for this setup: it seems that the beam will exit the target field horizontally for this setup (is this the case ?) and will this exit beam go to the local dump or to the hall A dump ?
- How is the local dump modified to meet the new requirements ?

- What are the effects on the target ?
- What is the phasespace coverage and the final physics outcome after this change ?

We suggest getting all parties in the same room at the same time (optics, physics design, Engineering design, RadCon, Target group) to minimize the chances that any potential complications are not overlooked.

2. Spectrometer optics with the target field: Due to the bending of electrons in the target field, the sieve slit is not effective in calibrating in plane and out of plane angles (th_tg and phi_tg) of the spectrometer. This angle calibration will have to rely completely on a simulation. Unlike in the standard no target-field case, the angle reconstruction depends very strongly on the momentum of the scattered electrons. Some results from the simulation can be calibrated against the elastic data, only at the energy corresponding to elastic scattering. The elastic differential recoil method used for angle calibration by PREX and HAPPEX experiments allows calibration of the in-plane angle of the simulation, however, calibrating the out of plane angle is not straight forward. A calibration procedure needs to be established soon. Since the experiment plans to measure cross sections, this calibration is crucial for the success of the experiment.
3. The feasibility of doing Moller measurements with the chicane needs to be established soon. The questions/concerns are:
    a. How much beam spray is caused by the Moller target, and is this acceptable for the chicane ?
    b. Can Moller measurements be performed with 150 nA beam current, and if so, how long should be measurement be to gain sufficient statistics ?

4. **Septa power supplies:** The collaboration must fix the septum maximum operating current and thus the power supply or power supplies required. The highest energy run will definitely require two DC supplies with their new AC feed and LCW. An additional power supply for the warm septum must be identified as quickly as possible. The HKS dipole supply may be suitable (the HKS splitter supply is in use by the Hall C Compton). Once the power supply has been nailed down, Hall A Engineering and the Work Coordinator can determine if there will be sufficient power and LCW in the hall to accommodate all the new power supplies and magnet.

5. **Heating of the local beam dump:** The committee has concerns about the heating of the local beam dump, with regard to modeling of thermal conductivity between the core and the lead shielding and through the lead shielding to the cooling plates. We recommend that this be studied further as needed and quantified more clearly.

6. **Background from Local Beam Dump:** The committee has serious concerns about the effect of the radiation created when the electron beam gets dumped in the center of the hall. Having a local beam dump in the hall, even at the modest currents of this experiment can be problematic. In Hall B during the TPE experiment a similar dump caused many interruptions in data-taking to reset computers and also to add shielding. That experiment used 120nA of beam and a 10 % radiator. The photon beam was dumped in a tungsten "beam blocker" (dump) which was in a helium bag and

surrounded by a large dipole and lots of shielding. Even so, there were problems and additional shielding had to be added.

In particular, lack of a re-entrant design could lead to significant radiation on the target platform. We recommend that a careful simulation is performed, in consultation with the RADCON group, to estimate the radiation level on the target platform. Then take steps to shield or relocate the sensitive electronics as needed.

We also have a modest concern about placing a beam dump just upstream of the septa, at the entrance to the spectrometers. In principle, backgrounds in the spectrometers from this dump should be small, but this is something to consider. We suggest that a GEANT simulation of backgrounds from the local dump be folded in with the simulation of the spectrometers to ensure no impact on the "signal".

7. The committee recommends further assurance that the safeguards that limit the power to the local dump are sufficiently robust and redundant. Use of an interlocked ionization chamber protecting the dump is suggested. This topic should be discussed with accelerator operations and engineering (safety systems).

Safety related concerns and recommendations:

a. Verify and document that the experimental apparatus (polarized target) for these experiments (E08-027 & E08-007) comply with Jefferson Lab Environment, Health and Safety Manual, Chapter 6151 - Pressure Systems. http://www.jlab.org/ehs/ehsmanual/6151.htm This will be of value to the collaboration in the preparation for the safety readiness review later this year.
b. Ensure necessary and dedicated radiation control department support to the collaboration in the necessary effort to understand radiation effects in the yet finalized beam line/dump designs and the effect on equipment in the hall.
c. Ensure in the absence of a yet to be determined laboratory staff position, Integration Coordinator, that the experiment project manager, operations, engineering divisions designated personnel, and radiation control department designated personnel for these experiments are effectively communicating to met the individual division and group milestones, as well as the collective milestones for the experiments. Reminder, there will be demands of these non physics division resources as the laboratory is working in what is known as the six month scheduled accelerator down, scheduled to begin Friday, May 13.

Other Concerns Raised by Committee Members

1. Some tasks in the schedule do not have manpower assigned (for example, the integration of a second power-supply for the Septa).

2. The schedule of runs needs to be looked at in greater detail with an integrated approach between Accelerator and all Halls as the Hall A and Hall C single pass runs do not seem

compatible. This and the issue of the 1.7 GeV energy where only Hall A can run should be discussed with the lab management and the other halls, and finalized soon.

3. The FZ2 stand must be finished and tested ASAP.

4. The End Station LCW plant is overextended with the Q-Weak experiment requirements. Any additional LCW demand to support g2p and GEp may require time and money to accommodate. The collaboration needs to be aware of this, especially with the addition of a second septum power supply, and communicate with Carroll Jones.

5. With such little float in the run schedule, the collaboration should understand that the Accelerator will be starting up from a major maintenance/upgrade period. Proactive efforts to coordinate with Accelerator during commissioning to address challenges (current and position stability, etc.) and communicate "acceptable" parameters will help the experiment to be successful.

6. There will be large demands on the Accelerator installation crew form the 12 GeV work. Keeping the team focused on Hall A installation if the 12 GeV work gets behind will be a challenge

7. g2p wants to measure the difference of absolute cross sections. It was stated that the absolute target thickness would be monitored using the proton elastic cross section. This makes sense, but it is also true that elastic scattering is typically the “standard” that helps one diagnose significant problems with the apparatus, i.e., poorly understood efficiencies or acceptance, etc. It would be nice of there could be an alternate target/process that would allow one to independently probe these latter issues – maybe carbon elastic scattering, or something similar ?

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